NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

COMPUTER INTEGRATED MANUFACTURING

NQF Level 4

April 2008

CONTENTS

SECTION A: PURPOSE OF THE SUBJECT ASSESSMENT GUIDELINES

This document provides the lecturer with guidelines to develop and implement a coherent, integrated assessment system for Computer Integrated Manufacturing in the National Certificates (Vocational). It must be read with the *National Policy Regarding Further Education and Training Programmes: Approval of the Documents, Policy for the National Certificates (Vocational) Qualifications at Levels 2 to 4 on the National Qualifications Framework (NQF)*. This assessment guideline will be used for National Qualifications Framework Levels 2-4.

This document explains the requirements for the internal and external subject assessment. The lecturer must use this document with the *Subject Guidelines: Computer Integrated Manufacturing* to prepare for and deliver Computer Integrated Manufacturing. Lecturers should use a variety of resources and apply a range of assessment skills in the setting, marking and recording of assessment tasks.

SECTION B: ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

1 ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

Assessment in the National Certificates (Vocational) is underpinned by the objectives of the National Qualifications Framework (NQF). These objectives are to:

- Create an integrated national framework for learning achievements.
- Facilitate access to and progression within education, training and career paths.
- Enhance the quality of education and training.
- Redress unfair discrimination and past imbalances and thereby accelerate employment opportunities.
- Contribute to the holistic development of the student by addressing:
  - social adjustment and responsibility;
  - moral accountability and ethical work orientation;
  - economic participation; and
  - nation-building.

The principles that drive these objectives are:

- ***Integration***

To adopt a unified approach to education and training that will strengthen the human resources development capacity of the nation.

- ***Relevance***

To be dynamic and responsive to national development needs.

- ***Credibility***

To demonstrate national and international value and recognition of qualification and acquired competencies and skills.

- ***Coherence***

To work within a consistent framework of principles and certification.

- ***Flexibility***

To allow for creativity and resourcefulness when achieving Learning Outcomes, to cater for different learning styles and use a range of assessment methods, instruments and techniques.

- ***Participation***

To enable stakeholders to participate in setting standards and co-ordinating the achievement of the qualification.

- ***Access***

To address barriers to learning at each level to facilitate students' progress.

- ***Progression***

To ensure that the qualification framework permits individuals to move through the levels of the national qualification via different, appropriate combinations of the components of the delivery system.

- ***Portability***

To enable students to transfer credits of qualifications from one learning institution and/or employer to another institution or employer.

- ***Articulation***

To allow for vertical and horizontal mobility in the education system when accredited pre-requisites have been successfully completed.

- ***Recognition of Prior Learning***

To grant credits for a unit of learning following an assessment or if a student possesses the capabilities specified in the outcomes statement.

- ***Validity of assessments***

To ensure assessment covers a broad range of knowledge, skills, values and attitudes (SKVAs) needed to demonstrate applied competency. This is achieved through:

  - clearly stating the outcome to be assessed;
  - selecting the appropriate or suitable evidence;
  - matching the evidence with a compatible or appropriate method of assessment; and
  - selecting and constructing an instrument(s) of assessment.

- ***Reliability***

To assure assessment practices are consistent so that the same result or judgment is arrived at if the assessment is replicated in the same context. This demands consistency in the interpretation of evidence; therefore careful monitoring of assessment is vital.

- ***Fairness and transparency***

To verify that no assessment process or method(s) hinders or unfairly advantages any student. The following could constitute unfairness in assessment:

  - Inequality of opportunities, resources or teaching and learning approaches
  - Bias based on ethnicity, race, gender, age, disability or social class
  - Lack of clarity regarding Learning Outcome being assessed
  - Comparison of one student's work with another, based on learning styles and language

- ***Practicability and cost-effectiveness***

To integrate assessment practices within an outcomes-based education and training system and strive for cost and time-effective assessment.

2 ASSESSMENT FRAMEWORK FOR VOCATIONAL QUALIFICATIONS

The assessment structure for the National Certificates (Vocational) qualification is as follows:

2.1 Internal continuous assessment (ICASS)

Knowledge, skills values, and attitudes (SKVAs) are assessed throughout the year using assessment instruments such as projects, tests, assignments, investigations, role-play and case studies. The internal continuous assessment (ICASS) practical component is undertaken in a real workplace, a workshop or a "Structured Environment". This component is moderated internally, and externally quality assured by Umalusi. All internal continuous assessment (ICASS) evidence is kept in a Portfolio of Evidence (PoE) and must be readily available for monitoring, moderation and verification purposes.

2.2 External summative assessment (ESASS)

The external summative assessment is either a single paper or set of written papers set to the requirements of the Subject Learning Outcomes. The Department of Education administers the theoretical component according to relevant assessment policies.

A compulsory component of external summative assessment (ESASS) is the **integrated summative assessment task (ISAT).** This assessment task draws on the students' cumulative learning throughout the year. The task requires **integrated application of competence** and is executed under strict assessment conditions. The task should take place in a simulated or "Structured Environment". The integrated summative assessment task (ISAT) is the most significant test of students' ability to apply acquired knowledge.

The integrated assessment approach allows students to be assessed in more than one subject with the same integrated summative assessment task (ISAT).

External summative assessments will be conducted annually between October and December, with provision made for supplementary sittings.

3 MODERATION OF ASSESSMENT

3.1 Internal moderation

Assessment must be moderated according to the internal moderation policy of the Further Education and Training (FET) college. Internal college moderation is a continuous process. The moderator's involvement starts with the planning of assessment methods and instruments and follows with continuous collaboration with and support to the assessors. Internal moderation creates common understanding of Assessment Standards and maintains these across vocational programmes.

3.2 External moderation

External moderation is conducted by the Department of Education, Umalusi and, where relevant, an Education and Training Quality Assurance (ETQA) body according to South African Qualifications Authority (SAQA) and Umalusi standards and requirements.

The external moderator:

- monitors and evaluates the standard of all summative assessments;
- maintains standards by exercising appropriate influence and control over assessors;
- ensures proper procedures are followed;
- ensures summative integrated assessments are correctly administered;
- observes a minimum sample of ten (10) to twenty-five (25) percent of summative assessments;
- gives written feedback to the relevant quality assuror; and
- moderates in case of a dispute between an assessor and a student.

Policy on inclusive education requires that assessment procedures be customised for students who experience barriers to learning, and supported to enable these students to achieve their maximum potential.

4 PERIOD OF VALIDITY OF INTERNAL CONTINUOUS ASSESSMENT (ICASS)

The period of validity of the internal continuous assessment mark is determined by the *National Policy on the Conduct, Administration and Management of the Assessment of the National Certificates (Vocational).*

The internal continuous assessment (ICASS) must be re-submitted with each examination enrolment for which it constitutes a component.

5 ASSESSOR REQUIREMENTS

Assessors must be subject specialists and should ideally be declared competent against the standards set by the ETDP SETA. If the lecturer conducting the assessments is not a qualified educator or has not been declared a competent assessor, an assessor who has been declared competent may be appointed to oversee the assessment process to ensure the quality and integrity of assessments.

6 TYPES OF ASSESSMENT

Assessment benefits the student and the lecturer. It informs students about their progress and helps lecturers make informed decisions at different stages of the learning process. Depending on the intended purpose, different types of assessment can be used.

6.1 Baseline assessment

At the beginning of a level or learning experience, baseline assessment establishes the knowledge, skills, values and attitudes (SKVAs) that students bring to the classroom. This knowledge assists lecturers to plan learning programmes and learning activities.

6.2 Diagnostic assessment

This assessment diagnoses the nature and causes of learning barriers experienced by specific students. It is followed by guidance, appropriate support and intervention strategies. This type of assessment is useful to make referrals for students requiring specialist help.

6.3 Formative assessment

This assessment monitors and supports teaching and learning. It determines student strengths and weaknesses and provides feedback on progress. It determines if a student is ready for summative assessment.

6.4 Summative assessment

This type of assessment gives an overall picture of student progress at a given time. It determines whether the student is sufficiently competent to progress to the next level.

7 PLANNING ASSESSMENT

An assessment plan should cover three main processes:

7.1 Collecting evidence

The assessment plan indicates which Subject Outcomes and Assessment Standards will be assessed, what assessment method or activity will be used and when this assessment will be conducted.

7.2 Recording

Recording refers to the assessment instruments or tools with which the assessment will be captured or recorded. Therefore, appropriate assessment instruments must be developed or adapted.

7.3 Reporting

All the evidence is put together in a report to deliver a decision for the subject.

8 METHODS OF ASSESSMENT

Methods of assessment refer to who carries out the assessment and includes lecturer assessment, self-assessment, peer assessment and group assessment.

LECTURER ASSESSMENT	The lecturer assesses students' performance against given criteria in different contexts, such as individual work, group work, etc.
SELF-ASSESSMENT	Students assess their own performance against given criteria in different contexts, such as individual work, group work, etc.
PEER ASSESSMENT	Students assess another student's or group of students' performance against given criteria in different contexts, such as individual work, group work, etc.
GROUP ASSESSMENT	Students assess the individual performance of other students within a group or the overall performance of a group of students against given criteria.

9 INSTRUMENTS AND TOOLS FOR COLLECTING EVIDENCE

All evidence collected for assessment purposes is kept or recorded in the student's Portfolio of Evidence (PoE).

The following table summarises a variety of methods and instruments for collecting evidence. A method and instrument is chosen to give students ample opportunity to demonstrate that the Subject Outcome has been attained. This will only be possible if the chosen methods and instruments are appropriate for the target group and the Specific Outcome being assessed.

	METHODS FOR COLLECTING EVIDENCE		
	Observation-based (Less structured)	**Task-based** (Structured)	**Test-based** (More structured)
Assessment instruments	• Observation • Class questions • Lecturer, student, parent discussions	• Assignments or tasks • Projects • Investigations or research • Case studies • Practical exercises • Demonstrations • Role-play • Interviews	• Examinations • Class tests • Practical examinations • Oral tests • Open-book tests
Assessment tools	• Observation sheets • Lecturer's notes • Comments	• Checklists • Rating scales • Rubrics	• Marks (e.g. %) • Rating scales (1-5)
Evidence	• Focus on individual students • Subjective evidence based on lecturer observations and impressions	**Open middle**: Students produce the same evidence but in different ways. **Open end**: Students use same process to achieve different results.	Students answer the same questions in the same way, within the same time.

10 TOOLS FOR ASSESSING STUDENT PERFORMANCE

Rating scales are marking systems where a symbol (such as 1 to 5) or a mark (such as 5/10 or 50%) is defined in detail. The detail is as important as the coded score. Traditional marking, assessment and evaluation mostly used rating scales without details such as what was right or wrong, weak or strong, etc.

Task lists and **checklists** show the student what needs to be done. These consist of short statements describing the expected performance in a particular task. The statements on the checklist can be ticked off when the student has adequately achieved the criterion. Checklists and task lists are useful in peer or group assessment activities.

Rubrics are a hierarchy (graded levels) of criteria with benchmarks that describe the minimum level of acceptable performance or achievement for each criterion. Using rubrics provides a different way of assessing that cannot be compared to tests. Each criterion described in the rubric must be assessed separately. Mainly two types of rubrics, namely holistic and analytical, are used.

11 SELECTING AND/OR DESIGNING RECORDING AND REPORTING SYSTEMS

The selection or design of recording and reporting systems depends on the purpose of recording and reporting student achievement. **Why** particular information is recorded and **how** it is recorded determine which instrument will be used.

Computer-based systems, for example spreadsheets, are cost and time effective. The recording system should be user-friendly and information should be easily accessed and retrieved.

12 COMPETENCE DESCRIPTIONS

All assessment should award marks to evaluate specific assessment tasks. However, marks should be awarded against rubrics and not be simply a total of ticks for right answers. Rubrics should explain the competence level descriptors for the skills, knowledge, values and attitudes (SKVAs) that a student must demonstrate to achieve each level of the rating scale.

When lecturers or assessors prepare an assessment task or question, they must ensure that the task or question addresses an aspect of a Subject Outcome. The relevant Assessment Standard must be used to create the rubric to assess the task or question. The descriptions must clearly indicate the minimum level of attainment for each category on the rating scale.

13 STRATEGIES FOR COLLECTING EVIDENCE

A number of different assessment instruments may be used to collect and record evidence. Examples of instruments that can be (adapted and) used in the classroom include:

13.1 Record sheets

The lecturer observes students working in a group. These observations are recorded in a summary table at the end of each project. The lecturer can design a record sheet to observe students' interactive and problem-solving skills, attitudes towards group work and involvement in a group activity.

13.2 Checklists

Checklists should have clear categories to ensure that the objectives are effectively met. The categories should describe how the activities are evaluated and against which criteria they are evaluated. Space for comments is essential.

SECTION C: ASSESSMENT IN COMPUTER INTEGRATED MANUFACTURING

1 SCHEDULE OF ASSESSMENT

At NQF levels 2, 3 and 4, lecturers will conduct assessments as well as develop a schedule of formal assessments that will be undertaken in the year. All three levels also have an external examination that accounts for 50 percent of the total mark. The marks allocated to assessment tasks completed during the year, kept or recorded in a Portfolio of Evidence account for the other 50 percent.

The Portfolio of Evidence and the external assessment include practical and written components. The practical assessment in Computer Integrated Manufacturing must, where necessary, be subjected to external moderation by Umalusi or an appropriate Education and Training Quality Assurance (ETQA) body, appointed by the Umalusi Council in terms of Section 28(2) of the *General and Further Education and Training Quality Assurance Act, 2001 (Act No. 58 of 2001).*

2 RECORDING AND REPORTING

Computer Integrated Manufacturing, as is the case for all the other Vocational subjects, is assessed according to five levels of competence. The level descriptions are explained in the following table.

Scale of Achievement for the Vocational component

RATING CODE	RATING	MARKS %
5	Outstanding	80-100
4	Highly competent	70-79
3	Competent	50-69
2	Not yet competent	40-49
1	Not achieved	0-39

The programme of assessment should be recorded in the Lecturer's Portfolio of Assessment for each subject. The following at least should be included in the Lecturer's Assessment Portfolio:

- A contents page
- The formal schedule of assessment
- The requirements for each assessment task
- The tools used for each assessment task
- Recording instrument(s) for each assessment task
- A mark sheet and report for each assessment task

The college must standardise these documents.

The student's Portfolio of Evidence must include at least:

- A contents page
- The assessment tasks according to the assessment schedule
- The assessment tools or instruments for the task
- A record of the marks (and comments) achieved for each task

Where a task cannot be contained as evidence in the Portfolio of Evidence, its exact location must be recorded and it must be readily available for moderation purposes.

The following units guide internal assessment in Computer Integrated Manufacturing - Level 4:

NUMBER OF UNITS	ASSESSMENT	COVERAGE
3	Formal written tests	One or more completed topics
1	Internal written exam	All completed topics
3	Practical assessments	The related Subject Outcomes 2.1 writing a programme and operation sheet in the required format for machine operation and writing a programme to produce a simple component that conforms to the correct format of machine using M and G codes. 2.2 to operate the CNC machine, safety regulations, time limits and a written program in the required format. 3.1 Conducting Robot Programming. 4.1. conducting mechatronic system programme conformance to specification. 5.1 setting up of a CAD/CAM system in a computer integrated manufacturing application. 5.2 simple 2 &3-D engineering drawings using CAD and how to interface the CAD system with that of CNC and robotic systems to produce a simple component

ASSESSMENT OF

COMPUTER INTEGRATED MANUFACTURING

LEVEL 4

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN COMPUTER INTEGRATED MANUFACTURING – LEVEL 4

Topic 1: Identify and explain the function and operation of mechatronic systems and accessories

SUBJECT OUTCOME	
1.1 Describe an overview of CNC machines *Range: Types: CNC lathe and milling machine.* *Components: Chuck, light, guard, bed, vice, cutting tool, motor, the computer, software, interfacing.* *Process visualisation systems*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The parts that make up the CNC machine and their function are identified. • CNC machine safety and personal equipment requirements are identified. • CNC machine controls, tools, accessories and physical safety factors are identified. • The following are explained: ▪ the function of a CNC machine in industry ▪ the CNC machine as a technical system ▪ the operation of a CNC machine ▪ and listed: the differences between a NC and CNC machine and a conventional machine ▪ how interfacing is achieved between machine and computer • The advantages and disadvantages of a CNC machine are discussed with respect to a conventional machine. • The safety factors that must be considered before operation are listed. • Difficulties encountered when using a CNC machine are listed.	• Identify ▪ the parts that make up the CNC machine and the functions thereof ▪ CNC machine safety and personal equipment requirements ▪ CNC machine controls ▪ CNC machine tools and accessories ▪ physical safety factors • Explain ▪ the function of a CNC machine in industry ▪ the CNC machine as a technical system ▪ the operation of a CNC machine ▪ and list the differences between a NC and CNC machine and a conventional machine ▪ how interfacing is achieved between machine and computer • Discuss the advantages and disadvantages of a CNC machine with respect to a conventional machine • List the safety factors that must be considered before operation • List some of the difficulties encountered when using a CNC machine
ASSESSMENT TASKS OR ACTIVITIES	
• An assignment on an overview of CNC machines	

SUBJECT OUTCOME	
1.2 Provide an overview of robot systems	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• A robot system is defined. • The following are described: ▪ degrees of freedom and robot axes ▪ what is meant by the term “degrees of freedom” ▪ what is meant by point to point programming ▪ what is meant by a co-ordination system. ▪ what is meant by the term *Teach In* ▪ various end effectors that are used on robot systems • The main components that make up a robot system, and the various applications for a robot system are listed. • The correct robot system, and the correct end effecter are selected to suit application.	• Define a robot system • Describe ▪ degrees of freedom and robot axes ▪ what is meant by the term “degrees of freedom” ▪ what is meant by point to point programming ▪ what is meant by a co-ordination system ▪ what is meant by the term *Teach In* ▪ various end effectors that are used on robot systems • List ▪ the main components that make up a robot system ▪ the various applications for a robot system • Select ▪ the correct robot system to suit application ▪ the correct end effecter for application
ASSESSMENT TASKS OR ACTIVITIES	
• Investigations or research on an overview of robot systems	

Topic 2: Program and operate CNC machines to manufacture a simple mechatronic component

SUBJECT OUTCOME	
2.1 Conduct Numerical Control programming *Range: CNC operations: Geometric and path instruction (straight line, circle, spline). Technology instructions (spindle speed, feed rate). Switching instructions (tool change, coolant, part change). Laws and principles: speeds, feeds, material properties, CNC machining principles, flow charts*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following are explained: ▪ the CNC programming methodology ▪ and listed: the standard codes and formats ▪ what is meant by tooling paths ▪ what is meant by the common CNC operations ▪ and utilised: the fundamental underlying laws related to CNC Machines ▪ relationships between CNC programme and final machined component ▪ what is meant by programme sequencing ▪ the importance of setting time limits ▪ what is meant by co-ordination and XYZ • Drawings and documentation are interpreted and tool path geometry defined. • Tool path co-ordinates are calculated. • Programming elements and machine code functions are defined. • A programme and operation sheet are written in the required format for machine operation (speeds, feed and depth of cut considered). • A programme is written to produce a simple component that conforms to the correct format of machine using M and G codes.	• Explain ▪ the CNC programming methodology ▪ and list the standard codes and formats ▪ what is meant by tooling paths ▪ what is meant by the common CNC operations ▪ and utilise the fundamental underlying laws related to CNC Machines ▪ relationships between CNC programme and final machined component ▪ what is meant by programme sequencing ▪ the importance of setting time limits ▪ what is meant by co-ordination and XYZ • Interpret drawing and documentation and define tool path geometry • Calculate too path co-ordinates • Define programming elements • Define machine code functions. • Write a programme and operation sheet in the required format for machine operation (speeds, feed, and depth of cut considered) • Write a programme to produce a simple component that conforms to the correct format of machine using M and G codes
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks on the theoretical concepts. • Practical exercises on writing a programme and operation sheet in the required format for machine operation, and writing a programme to produce a simple component that conforms to the correct format of machine using M and G codes. • An open-book test on the interpretation of drawings, documentation, tool path co-ordinates and tool path geometry	

SUBJECT OUTCOME	
2.2 Operate a CNC machine *Range: Safety and operational procedures*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The various CNC operations to produce CNC machined components, the sequence of events to operate a CNC machine, safety requirements for safe operations, and setting up and operation procedures are listed. • The CNC machine is operated to produce a component safely using the correct sequence of operations. • Related safety regulations are adhered to (correct coolants, speeds and feed rates are used). • Time limits are set • A program is written in the required format.	• List the ▪ various CNC operations to produce CNC machined components ▪ sequence of events to operate the CNC machine ▪ safety requirements for safe operations ▪ setting up and operation procedures • Operate the CNC machine to produce a component safely using correct sequence of operations • Adhere to related safety regulations (correct coolants, speeds and feed rate used) • Set time limits • Write a programme in the required format
ASSESSMENT TASKS OR ACTIVITIES	
• Class questions and discussions and an assignment on the relevant theory. • Practical exercises to operate the CNC machine, safety regulations, time limits and a written program in the required format	

Topic 3: Program and operate a robot system in a manufacturing system application

SUBJECT OUTCOME	
3.1 Conduct robot programming	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Robot software, robot safety precautions and the function of the hand held programmer are described. • Industrial robots and manipulators are set up. • The robot system is turned on. • The robot system is programmed to perform function.	• Describe ▪ robot software ▪ robot safety precautions ▪ the function of the hand held programmer • Set up industrial robots and manipulators • Turn on the robot system • Programme the robot system to perform function
ASSESSMENT TASKS OR ACTIVITIES	
• Practical exercises, demonstrations and checklists on conducting robot programming	

Topic 4: Modify a mechatronic system programme to meet specification

SUBJECT OUTCOME	
4.1 Conduct mechatronic system programme conformance to specification	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The purpose of specification conformance, the implications of not meeting conformance, and the purpose of tool conformance are explained. • An existing programme is edited and modified to meet conformance. • Documentation is produced to meet conformance (machine accepts work piece without damage).	• Explain ▪ the purpose of specification conformance ▪ the implications of not meeting conformance ▪ the purpose of tool conformance • Edit and modify an existing programme to meet conformance • Produce documentation to meet conformance (machine accepts work piece without damage)
ASSESSMENT TASKS OR ACTIVITIES	
• Practical exercises with rubrics on conducting mechatronic system programme conformance to specification	

Topic 5: Produce a CAD drawing of a simple component, interface it with a CNC machine and robot system to produce the component in a CAD/CAM application

SUBJECT OUTCOME	
5.1 Set up a CAD/CAM/CNC/Robot mechatronic system	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The purpose of CAD/CAM in CNC manufacturing, and the interfacing procedure between systems are described. • The functions of the various system elements that make up a CAD/CAM system are identified and described. • CAD/CAM applications in industry, and their advantages and disadvantages are listed. • A Distributed Control System (DCS) (SCADA) is explained. • A CAD/CAM system is set up in a computer integrated manufacturing application.	• Describe ▪ the purpose of CAD/CAM in CNC manufacturing ▪ the interfacing procedure between systems • Identify and describe the functions of the various system elements that make up a CAD/CAM system • List ▪ CAD/CAM applications in industry ▪ the advantages and disadvantages of CAD/CAM applications • Explain what is meant by a Distributed Control System (DCS) (SCADA) • Set up a CAD/CAM system in a computer integrated manufacturing application
ASSESSMENT TASKS OR ACTIVITIES	
• An assignment or task on the function of the various system elements that make up a CAD/CAM system, CAD/CAM applications in industry, the advantages and disadvantages of CAD/CAM applications and Distributed Control System (DCS) (SCADA). • A project on the purpose of CAD/CAM in CNC manufacturing, and the interfacing procedure between systems. • Practical exercises on the setting up of a CAD/CAM system in a computer integrated manufacturing application	

SUBJECT OUTCOME	
5.2 Produce a CAD engineering drawing and interface it *Range: Drawing types: Simple Mechanical*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The procedure to produce a CAD drawing, the purpose of CAD drawing symbols, and how CAD/CAM interfacing can be achieved are explained. • The tool box of a CAD application programme is used. • A simple component drawing is produced, and a simple 2- and 3-D engineering drawing modified, using CAD. • The CAD system is interfaced with that of CNC and robotic systems to produce a simple component.	• Explain ▪ the procedure to produce a CAD drawing. ▪ the purpose of CAD drawing symbols. ▪ how CAD/CAM interfacing can be achieved • Use the tool box of a CAD application programme. • Produce ▪ and modify a simple 2- and 3-D engineering drawing using CAD. ▪ a simple component drawing. • Interface the CAD system with that of CNC and robotic systems to produce a simple component.
ASSESSMENT TASKS OR ACTIVITIES	
• An assignment or task on the procedure to produce a CAD drawing, the purpose of CAD drawing symbols, how CAD/CAM interfacing can be achieved and the use of the tool box of a CAD application program. • Demonstrations and practical exercises on simple 2- and 3-D engineering drawings using CAD, and how to interface the CAD system with that of CNC and robotic systems to produce a simple component	

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN COMPUTER INTEGRATED MANUFACTURING – LEVEL 4

4.1 Integrated summative assessment task (ISAT)

A compulsory component of the external assessment (ESASS) is the **integrated summative assessment task (ISAT)**. The integrated summative assessment task (ISAT) draws on the student's cumulative learning achieved throughout the year. The task requires **integrated application of competence** and is executed and recorded in compliance with assessment conditions.

Two approaches to the integrated summative assessment task may be as follows:

- The students are assigned a task at the beginning of the year which they will have to complete in phases throughout the year to obtain an assessment mark. A final assessment is made at the end of the year when the task is completed.

OR

- Students achieve the competencies throughout the year but the competencies are assessed cumulatively in a single assessment or examination session at the end of the year.

The integrated summative assessment task is set by an externally appointed examiner and is conveyed to colleges in the first quarter of the year.

The integrated assessment approach enables students to be assessed in more than one subject with the same integrated summative assessment task.

4.2 National Examination

A national examination is conducted annually in October or November by means of a paper(s) set and moderated externally. The following distribution of cognitive application should be followed:

LEVEL 4	KNOWLEDGE AND COMPREHENSION	APPLICATION	ANALYSIS, SYNTHESIS AND EVALUATION
	30%	50%	20%

MARK ALLOCATION PER QUESTION		
Students complete four of five possible application questions covering all the topics.		
Question 1:	Identify and explain the function and operation of mechatronic systems and accessories.	15%
Question 2:	Program and operate CNC machines to manufacture a simple mechatronic component.	30%
Question 3:	Program and operate a robot system in a manufacturing system application.	30%
Question 4:	Modify a mechatronic system programme to meet specification.	10%
Question 5:	Produce a CAD drawing of a simple component and interface it with a CNC machine and robot system to produce it in a CAD/CAM application.	15%
	TOTAL	**100**